COST OF PRODUCING LETTUCE IN HAWAII

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SUMMARY

1. This report presents findings of a survey carried out in March and April, 1961, to determine the cost of producing semi-head (Manoa) and head lettuce in Hawaii.

2. Locally-grown lettuce amounts to around 3 million pounds annually. Another 3 million pounds are imported from California each year.

3. The Honolulu market is gradually becoming more dependent on California-grown head lettuce. Local head lettuce production is declining in both absolute and relative terms. Production of semi-head lettuce, however, which is not imported, has increased since 1950--from 740,000 pounds (1950) to 1,560,000 pounds (1960).

4. Semi-head lettuce is grown on Oahu on small family farms (2 to 5 acres) with much hand labor. Head lettuce is grown commercially on Hawaii and Maui, generally on larger family farms (up to 20 acres) with less hand labor and more power-operated machinery.

5. The patterns of production and prices of head and semi-head lettuce are in complete contrast. Production of head lettuce on Hawaii and Maui is markedly seasonal (low in fall and winter; high in spring and summer) while farmers' prices are steady. Production of semi-head lettuce on Oahu is relatively steady throughout the year, while farmers' prices fluctuate considerably.

6. Some of this price fluctuation (semi-head lettuce) is attributable to the pronounced "stickiness" of marketing margins.

7. Typical expenditures in producing 1 acre of semi-head lettuce (13,000 pounds per harvested acre) on Oahu in spring, 1961, was $666, or just over 5 cents a pound. Labor accounted for $286.50 per acre, or 43 percent of total costs.

8. Typical cost of producing 1 acre of head lettuce (9,000 pounds per harvested acre) on Hawaii in spring, 1961, and shipping it to Honolulu was $627.40, or just under 7 cents per pound (without allowing for heavy spoilage). Farm labor accounted for $94 per acre, or 14 percent of total costs.

9. Local farmers produce lettuce at 2 or 3 times the cost of the imported item (f.o.b. basis) yet are able to meet this competition through the protection given them by freight costs amounting to 5½ to 6 cents per pound on lettuce shipped from California.

CONTENTS

TABLES

FIGURES

COVER PHOTO

Typical lettuce plot at Koko Head, Oahu. (Photo by Masao Miyamoto.)

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INTRODUCTION

This report presents findings of a survey carried out in March and April, 1961, to determine the cost of producing lettuce in Hawaii. Local farms currently produce about one-half of lettuce consumed annually in the State. California provides the remainder. Since 1950, local annual production of lettuce has remained around 3 million pounds. Shipments into the State have more than doubled during this period, from 1.4 million pounds in 1950, to 3.1 million pounds in 1960.

An examination of cost data which follow provides some indication why the relative importance of the locally-grown commodity has recently declined. Island vegetable growers and consumers, too, who are often tantalized by the knowledge that Hawaii could grow practically all the vegetables it consumes, but doesn't, may also derive some benefit from the following analysis.

SOME ECONOMIC FEATURES OF LETTUCE PRODUCTION IN HAWAII

Table 1 summarizes the pattern of lettuce production in Hawaii between 1950 and 1960. During this 11-year period the three islands of Hawaii, Oahu (the most densely populated), and Maui--in that order--provided almost all commercial supplies from local sources. Annual production fluctuated considerably on each of these islands yet certain trends do emerge for the 11-year period. A marked upward shift took place on Oahu. Annual production more than doubled from 740,000 pounds in 1950 to 1,560,000 pounds in 1960. Lettuce production on Hawaii generally declined. It was 1,900,000 pounds in 1950 (2,400,000 pounds in 1951) and 1,540,000 pounds in 1960. Maui's annual contribution averaged about 350,000 pounds; output for the period as a whole on that island remaining unchanged except for some violent fluctuations of a temporary nature (for example, 285,000 pounds in 1954; 565,000 pounds in 1955). The net effect of these movements was that in 1960 Oahu and Hawaii each supplied 45 percent of total annual State production, Maui producing the remaining 10 percent. This contrasts with the corresponding situation in 1950-51 when the island of Hawaii supplied 68 percent and Oahu only 20 percent of total local supplies.

A detailed analysis is not required to explain this shift in the production pattern. Oahu produces a different lettuce--the semi-head (Manoa) type--from the crisp-head lettuce grown on Neighbor Islands. The semi-head type is prepared for sandwich fillings, salad decorations, and to some extent for salads, while the crisp-head lettuce is prepared primarily for salads. Oahu producers do not have to compete directly with shipments from California; growers of crisp-head lettuce do. Relatively poor marketing facilities have handicapped any expansion of crisp-head lettuce production on Neighbor Islands. In addition, other crops such as celery have recently provided Neighbor Island farmers with a more profitable alternative than lettuce. Modern refrigeration and freight services ensure the arrival of lettuce from California in good condition. Lettuce from Hawaii and Maui frequently suffers heavy spoilage and shrinkage from lack of these essential requirements. Oahu lettuce growers are generally within a few minutes truck ride of Honolulu, their chief market; spoilage is not such a major problem for them.

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Table 1. Acreage, average yield per acre, and total annual production of lettuce on Oahu, Hawaii, Maui, and Kauai, 1950-60

Year	Acreage harvested					Average yield per acre					Total production				
	Oahu	Hawaii	Maui	Kauai	Total	Oahu	Hawaii	Maui	Kauai	Total	Oahu	Hawaii	Maui	Kauai	Total
	Acres				Acres	1,000 pounds				1,000 pounds	1,000 pounds				1,000 pounds
1950	59	219	41	4	323	12.5	8.7	6.1	6.2	9.0	740	1,900	250	25	2,915
1951	46	246	45	5	342	11.7	9.8	8.6	6.0	9.8	540	2,400	385	30	3,355
1952	53	217	38	6	314	13.7	9.9	8.6	6.7	10.3	725	2,140	325	40	3,230
1953	66	192	19	-	277	14.0	9.4	11.3	-	10.6	925	1,810	215	-	2,950
1954	66	185	25	-	276	13.9	8.3	11.4	-	9.9	915	1,530	285	-	2,730
1955	72	215	50	-	337	16.6	9.3	11.3	-	11.2	1,195	2,000	565	-	3,760
1956	112	223	43	-	378	11.2	7.6	7.0	-	8.6	1,250	1,700	300	-	3,250
1957	109	223	33	-	365	11.0	7.9	9.7	-	9.0	1,200	1,765	320	-	3,285
1958	107	199	44	-	350	13.6	8.6	9.9	-	10.3	1,455	1,715	435	-	3,605
1959	110	154	50	-	314	12.9	7.9	7.4	-	9.6	1,420	1,215	370	-	3,005
1960	110	132	39	-	281	14.2	11.7	8.9	-	12.3	1,560	1,540	350	-	3,450

Source: Statistics of Hawaiian Agriculture (annual). Hawaii Cooperative Crop and Livestock Reporting Service, cooperating with United States Department of Agriculture, Agricultural Marketing Service.

No very distinct trends have occurred in yield per harvested acre within recent years. Typically, yields on Oahu average around 13,200 pounds per harvested acre (table 1), some 4,000 pounds more than the corresponding average yield on Hawaii and Maui. Wide annual variations in yield are characteristic of all three producing regions. For example, Maui's average yield per harvested acre in 1955 was 11,300 pounds, in 1956 it was only 7,000 pounds climbing to 9,700 pounds in 1957.

Disease and unfavorable weather are major causes of such wide changes in yields. Oahu's heavier yields are largely the result of more intensive cultivation than on Neighbor Islands.

Area of lettuce harvested in the State fluctuated between 276 acres and 378 acres between 1950 and 1960, averaging 323 acres. Oahu's lettuce growing area increased from 59 acres in 1950 to 110 in 1960; Hawaii's fell from 219 acres to 132 acres in this period while Maui's fluctuated around 40 to 45 acres.

Area of land in lettuce at any time is usually about one-quarter of the total area harvested, as from 3 to 5 crops are harvested on the same plot each year. Thus in November, 1960, a total of 55 acres were under lettuce cultivation in the State while 20 acres were harvested. Successive monthly harvestings are normally within the range of 20 to 26 acres. Planting and harvesting continue on a 12-month basis with only a slight reduction in area cultivated in the winter months on Oahu. Production is much more seasonal on Hawaii and Maui (figure 1).

Lettuce production in Hawaii contrasts sharply with large-scale California lettuce production. Island vegetable farms are small--averaging about 5 acres; successive lettuce plantings may be as small as one-fortieth of an acre and are not likely to be more than 2½ acres.

Family labor is the basis of Hawaii's small vegetable farms. Land scarcity on Oahu has caused these farmers to use labor very intensively on their relatively small units. On the island of Hawaii where vegetable farms are larger the intensity of labor use is much lower. These differences are shown later in tables 3 and 4.

Table 2 shows the size distribution of lettuce plots under cultivation in January, 1961. Each plot on an Oahu vegetable farm is generally divided into smaller "beds" at different stages of growth in order to have available a steady supply of lettuce.

Figure 1 (A, B) shows the pattern of marketing during 1957-60 of the two local types of lettuce--the quantities of inshipments of head lettuce from California and the Honolulu wholesale prices for head and semi-head lettuce. A comparison of figures 1A and 1B reveals some important differences in the pricing and supply of head and semi-head lettuce in the Honolulu market.

The pattern of marketing from Neighbor Islands to Honolulu is markedly seasonal (figure 1A). Production is relatively heavy in spring and summer, falling off sharply in the fall to a low winter level. Until fairly recently, inshipments of head lettuce from California have followed a reverse pattern. They fell sharply in the period of high local production (March-June) and were relatively high in months of low Island production. As local production has gradually been reduced, mainland lettuce inshipments have become relatively more stable.

Prices of head lettuce in Honolulu are shown in figure 1A to have been relatively stable in recent years. This situation is the result of plentiful supplies of

Table 2. Size distribution of lettuce plots on Hawaiian vegetable farms, January, 1961

Size of plot	Number of farms	Area in lettuce
Acres		Acres
Less than ¼	19	3.3
¼ - ½	23	10.0
½ - 1	16	12.3
1 - 2	7	9.4
2 and above	6	16.3
Total	71	51.3

Source: Hawaii Cooperative Crop and Livestock Reporting Service, cooperating with U. S. Department of Agriculture.

California lettuce being available at any time to meet local shortages and to the reduction of inshipments when local supplies were large. Thus Island producers of head lettuce cannot gain from high "scarcity" prices in the off-seasons (late fall and winter). This potential loss of extra revenue is probably far outweighed, however, by the gain resulting from stable prices when harvests are good. The important element of price uncertainty is largely absent from a farmer's calculations of possible advantages of lettuce growing over some alternative crop. However, differences in some wholesalers' methods of purchasing local and mainland lettuce do create some uncertainty for the local producer. Local market prices of commodities such as lettuce which are not wholly produced in the Islands are determined by the landed cost of the mainland produce plus a margin of profit for the local dealers. Island produce is mainly handled on a consignment sale basis. Imported produce is "usually bought outright and thus represents an investment on which the dealer must recover something above landed cost if he is to realize any profit."[2/] A dealer who handles both local and imported produce may, and probably does, sometimes find himself involved in a "conflict of interest" involving the principle of equity and his profit.

Figure 1B shows that marketings of semi-head lettuce are generally relatively stable while price fluctuates considerably. This, of course, contrasts with the price and production patterns of Island head lettuce where price is stable and production fluctuates seasonally. These different patterns stem partly from the fact that semi-head lettuce is produced from local sources alone while the head type of lettuce comes from local and mainland sources. Even a relatively small change in quantity of semi-head lettuce induces a significant change in price at the wholesale level and an even greater proportional change at the farm level. Demand for semi-head lettuce is thus inelastic--responding very little to small changes in price.

An important factor which works to the disadvantage of the Island producer of semi-head lettuce is the stability of retail prices and the "stickiness" of marketing

2/ C. W. Peters, Robert H. Reed, C. Richard Creek, Margins, Shrinkage, and Pricing of Certain Fresh Vegetables in Honolulu, Agricultural Economics Bulletin 7, Hawaii Agricultural Experiment Station, University of Hawaii, June, 1954, p. 27. This bulletin deals in great detail with certain aspects of vegetable marketing in Honolulu.

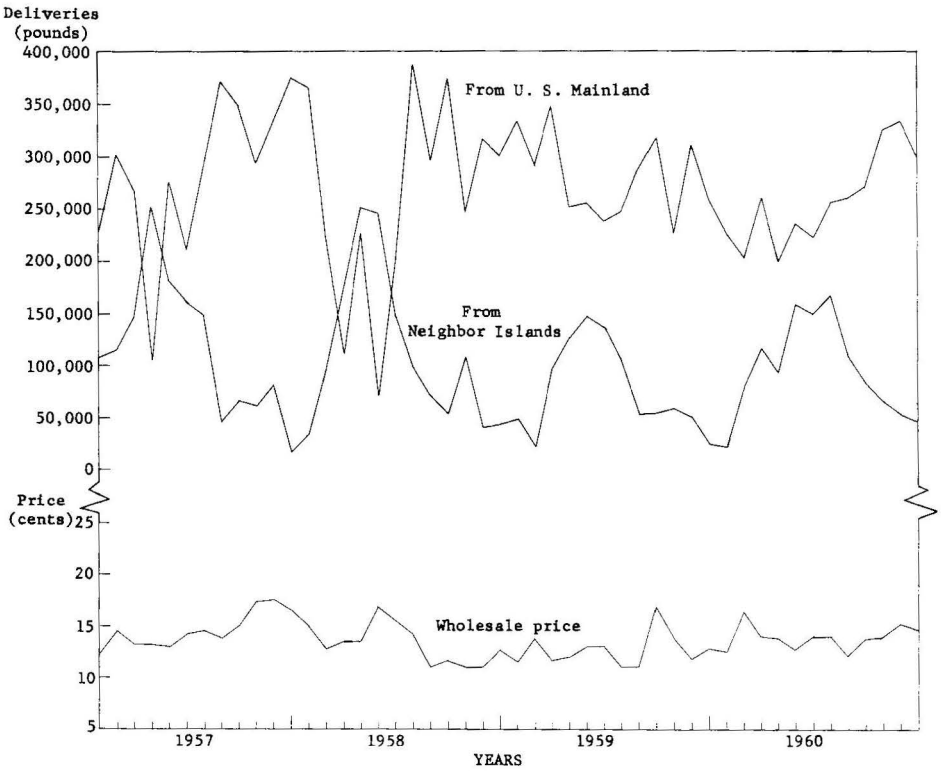

Figure 1A. Deliveries of head lettuce to Honolulu from U. S. Mainland and Neighbor Islands and wholesale prices, 1957-60.

Source: Hawaii Cooperative Crop and Livestock Reporting Service.

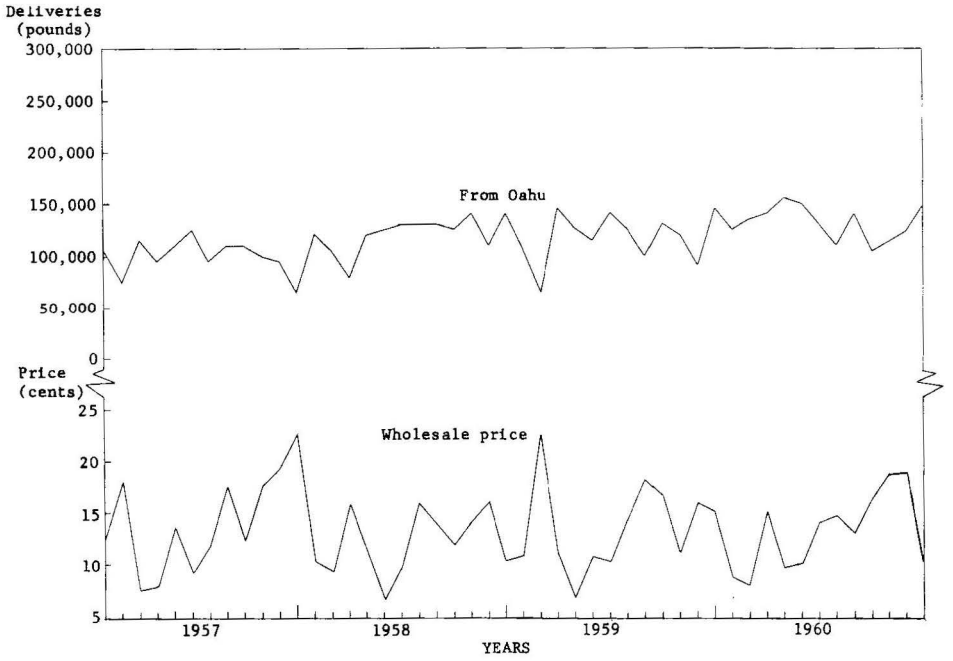

Figure 1B. Deliveries of semi-head lettuce to Honolulu from Oahu and wholesale prices, 1957-60.

Source: Hawaii Cooperative Crop and Livestock Reporting Service.

margins. Figure 2 shows retail and farm prices of semi-head lettuce for the period 1958-60. The different movements of the two sets of prices is clearly illustrated. What effect does this phenomenon have on farmers' returns?

Local data on the "stickiness" of marketing margins, supplemented by similar research elsewhere,[3/] indicate that the percentage share of consumers' expenditure going to distributors varies inversely with absolute changes in retail prices. It is also generally true that this stickiness is much greater with retailers' margins than with wholesalers'. Thus when prices received by farmers are low most retail mark-ups change very little in absolute terms. This situation has several explanations: (1) demand for most farm products at the retail level is usually inelastic (below unity) so that gross income may be sharply reduced as prices fall and supplies increase, thus providing the retailer with an incentive for inflexible margins; (2) plain "inertia" on the part of dealers; (3) spoilage rates tend to increase as prices fall, thus causing total selling costs to rise; (4) sticky margins discourage production when markets are glutted and give the producer a greater incentive to market produce when prices are high and supplies relatively scarce.

Although valid reasons exist for the widespread adoption of rigid margins in produce marketing, a conflict undoubtedly exists between retailers' and farmers' interests. Farmers may reasonably expect prices paid by consumers to be substantially less in a period of plenty than in a period of scarcity. They do not generally accept the position that <u>their</u> prices alone should move sharply downwards while retailers drop their prices only slightly if at all. Let all take the same percentage cut in price!

A detailed analysis of marketing procedures and margins is not part of this study. However, it is important to note how farmers' returns and their pattern of production are closely influenced by the system of marketing employed. Under the current system local producers of semi-head (Manoa) lettuce, in particular, face considerable price uncertainty which stems largely from the rigidity existing in retail mark-ups.

COST OF PRODUCTION

Typical production costs of semi-head and head lettuce have been prepared from a survey carried out on 12 farms on Oahu and Hawaii during March and April, 1961. The costing procedure adopted was similar to that used in an earlier study.[4/] Family labor was charged at $1 per hour, standard rates were used for power and equipment (see table 3), and other inputs were charged at actual cost.

Table 3 summarizes typical expenditures involved in producing 1 acre of semi-head lettuce (yielding 13,000 pounds) on Oahu in 1961. Table 4 summarizes similar data for head lettuce grown on Hawaii (yielding 9,000 pounds). Costs are shown on a <u>per acre</u> and on a <u>per pound</u> basis. It is important to note that <u>per acre</u> costs do not vary as much as <u>per pound</u> costs on the same farm at different times of the year, or on different farms at the same time.

3/ <u>Ibid</u>., pp. 10-17.

G. R. Allen, <u>Agricultural Marketing Policies</u>, Basil Blackwell, Oxford, 1959, ch. 6, pp. 111-140.

4/ J. A. Mollett, <u>Cost of Producing Cucumbers in Hawaii</u>, Agricultural Economics Report No. 44, Hawaii Agricultural Experiment Station, University of Hawaii, February, 1960, p. 8.

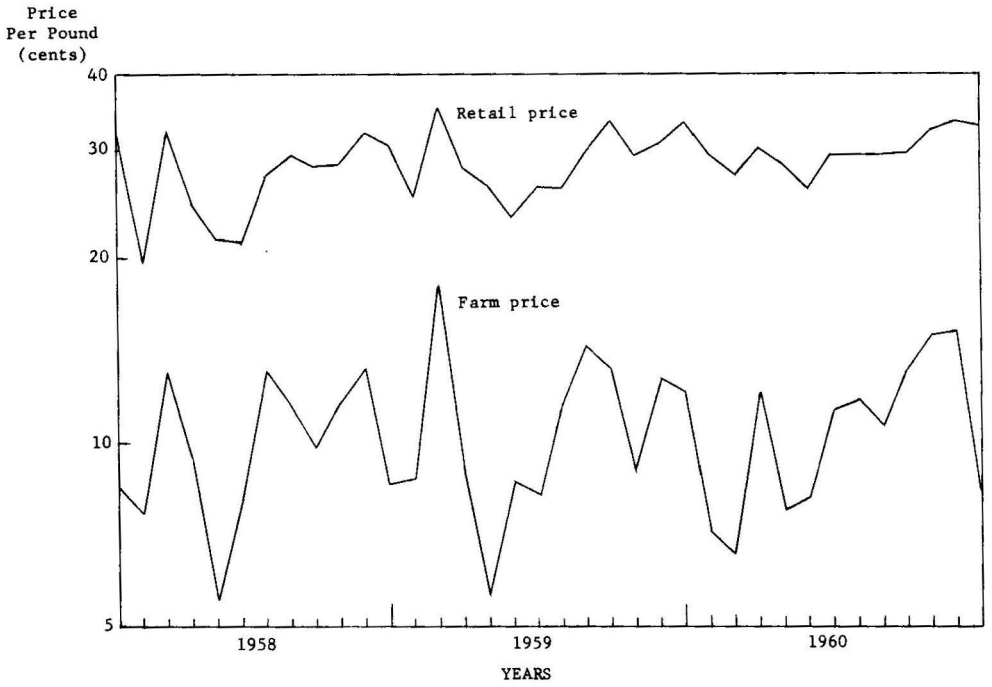

Figure 2. Retail and farm prices of semi-head lettuce, Honolulu, 1958-60.

Source: Statistics of Hawaiian Agriculture, Hawaii Cooperative Crop and Livestock Reporting Service.

The typical cost of producing 1 acre of semi-head lettuce (13,000 pounds per harvested acre) on Oahu in spring, 1961, was about $666, or just over 5 cents a pound. Table 3 shows that labor amounting to $286.50 per acre, or 43 percent of total costs, was the most important single item of expense. A total of 135.5 hours was typically spent on seedbed preparation, plantings, and other operations up to harvest. Market preparation (which involves washing the lettuce, trimming, and crating it) and field harvesting together amounted to 151 hours.

Materials (other than gas and oil used in operating equipment) amounted to $249.95. Crates at $90 per acre were the most expensive single item, followed by fertilizers ($76), water ($44.10), manure ($24), fungicides ($6.42), seeds ($4.75), and insecticides ($4.18).

Equipment costs at $74.80 per acre mainly consisted of the charge for use of a truck ($66) in marketing the crated lettuce.

Rent at an annual rate of $100 per acre was charged at one-fifth this amount, as five crops were usually taken from the same plot each year. Taxes at $16 and sundries at $18.50, per acre, complete the cost picture.

Several interesting facts emerge from a comparison of the cost of growing lettuce on Oahu (table 3) and on Hawaii (table 4). The total per acre costs are not very different if costs of shipping the lettuce to Honolulu are included. A typical cost of producing a 9,000-pound crop at Kamuela (Hawaii) and shipping it to Honolulu was $627.40. This compares with a corresponding figure of $665.75 for a crop grown at Koko Head (Oahu)--a difference of only 6 percent. If, however, yield is taken into account and costs are calculated on a per pound basis, a wide difference emerges between Oahu (5.12 cents) and Hawaii (6.97 cents). Hawaii's cost disadvantage is widened even farther when spoilage losses (sometimes heavy) are considered. Hawaii has lower production costs up to the point of shipping, even with much smaller yields per acre (9,000 pounds on Hawaii as compared with Oahu's 13,000 pounds), but relatively high freight charges to Honolulu tip the advantage in Oahu's favor.

Table 3. Typical cost of producing 1 acre of semi-head lettuce (13,000 pounds) and 1 pound of lettuce, Oahu, 1961

Item	Unit	Unit cost	Units used	Cost	
				Per acre	Per pound
		Dollars		Dollars	Cents
Labor					
Seedbed preparation and planting	Hour	1.00	10.5	10.50	
Growing operations	Hour	1.00	125.0	125.00	
Harvesting, market preparation	Hour	1.00	114.5	114.50	
Shipping to Honolulu	Hour	1.00	36.5	36.50	
Total			286.5	286.50	2.20
Materials					
Fertilizers	100 pounds	4.75	16	76.00	
Manure	Cubic yard	6.00	4	24.00	
Fungicides	Pound	1.07	6	6.42	
Insecticides	Pound	.78	6	4.68	
Seeds	Pound	4.75	1	4.75	
Water	Acre-inch	6.30	7	44.10	
Crates	One	.15	600	90.00	
Total				249.95	1.92
Equipment					
Power cultivator	Hour	.40	6	2.40	
Power spray	Hour	.80	3	2.40	
Truck	Hour	3.00	22	66.00	
Irrigation	Month	2.00	2	4.00	
Total				74.80	0.58
Rent	Acre	100.00	.2	20.00	
Taxes	-			16.00	
Sundries	-			18.50	
TOTAL				665.75	5.12

Table 4. Typical cost of producing 1 acre of head lettuce (9,000 pounds) and 1 pound of lettuce, Hawaii, 1961

Item	Unit	Unit cost	Units used	Cost	
				Per acre	Per pound
		Dollars		Dollars	Cents
Labor					
Seedbed preparation and planting	Hour	1.00	4.5	4.50	
Growing operations	Hour	1.00	24.5	24.50	
Harvesting and market preparation	Hour	1.00	58.0	58.00	
Shipping to depot	Hour	1.00	7.0	7.00	
Total			94.0	94.00	1.04
Materials					
Fertilizers	100 pounds	4.05	13	52.65	
Manure	Cubic yard	5.25	5	26.25	
Fumigants	Gallon	3.25	8	26.00	
Herbicides	Gallon	2.05	2	4.10	
Insecticides	Pound	.55	4	2.20	
Fungicides	Pound	.90	4	3.60	
Seeds	Pound	4.75	1	4.75	
Water	Acre-inch	8.41	9.5	79.90	
Crates	One	.50	200	100.00	
Total				299.45	3.33
Equipment					
Truck	Hour	3.00	6	18.00	
Tractor	Hour	1.25	12	15.00	
Power spray	Hour	.80	5.5	4.40	
Irrigation	Month	2.00	2	4.00	
Cultivation	Hour	.70	6.5	4.55	
Total				45.95	0.51
Rent	Acre	40.00	.25	10.00	
Taxes				6.00	
Sundries				14.00	
Freight to Honolulu				158.00	
TOTAL				627.40	6.97

Labor used in lettuce production on Hawaii at 94 hours per acre was only one-third of the typical Oahu figure of 286 hours. This difference is partly a result of the smaller quantity of lettuce to be harvested per acre in Hawaii, and of the lesser amount of time spent in delivering lettuce to the local collection center (for eventual delivery to the ocean barges). The difference also stems from harvesting methods. Lettuce on the island of Hawaii is harvested in a manner somewhat similar to that practiced on the U. S. Mainland--it is crated dry, in the field, and loaded directly onto trucks. This contrasts with the situation on Oahu where lettuce is handled several times before it eventually is crated and loaded on a truck for market.

Materials typically cost about $300 per acre (table 4) on lettuce grown on Hawaii. Major items were crates ($100), water ($79.90), fertilizers ($52.65), manure ($26.25), and fumigants ($26).

Equipment costs at $45.95 per acre on Hawaii were well below similar costs on Oahu ($74.80). If truck costs are deducted this situation is reversed. Such costs then become $27.95 on Hawaii and only $8.80 on Oahu. This last set of figures points up one of the chief differences in lettuce production methods on the two islands. Oahu lettuce growers apply much physical labor to their relatively small plots. Hawaii growers generally use much less physical labor, relying more on tractor power on their considerably large lettuce plots (up to 3 acres as contrasted with ¼ to ½ acre on Oahu). Relatively low rent amounting to an annual rate of $40 per acre at Kamuela (Hawaii), (table 4), is a factor in the Neighbor Island's favor. It compensates, however, for only a small part of the freight disadvantage of Hawaii in shipping produce to Honolulu.

As mentioned earlier, wide differences exist in the cost per pound of lettuce, as yield per acre varies in both of the growing areas. Cost per acre tends to remain unchanged over a range of yields. Harvesting is the cost item which varies most as yields vary. Other costs may largely be regarded as "sunken costs." Local costs are high compared with the corresponding costs of producing lettuce in California. Specialized growing areas in California produce lettuce (f.o.b.) at 1½ to 2½ cents per pound, fetching a wholesale price in San Francisco of between 3 to 5 cents. The corresponding wholesale price in Honolulu is usually around 10 to 11 cents per pound and the farm price some 20 percent below the Honolulu wholesale price.

Thus local farmers produce a commodity at 2 to 3 times the cost of the imported item (f.o.b. basis) yet are able to meet this competition through the protection given them by freight costs amounting to 5½ to 6 cents per pound on lettuce shipped from California. Perhaps it might be more correct to state "were able to meet Californian competition" because it seems that for head lettuce, at least, local production is gradually assuming less significance.

Cost data presented in this report suggest that the trend will be toward even greater reliance on mainland supplies of head lettuce. Large-scale Californian production and harvesting methods cannot be duplicated locally for the relatively small quantity of lettuce marketed in Hawaii. Protection afforded by relatively high oceanic freight rates on mainland produce gives local farmers the benefit of a relatively high Honolulu price but this is a small gain if local costs are so high. Semi-head lettuce is placed in a more favorable situation for local growers--provided they can find suitable land to grow it on!

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